tion all this would produce only a [illegible] or no result; for without such aid differences of all kinds would, from the two following causes, soon disappear. In [illegible] lot of pigeons many more young birds are killed or die than are reared to maturity; so that an individual having any peculiar character, if not selected, would run a good chance of being destroyed; and if not destroyed, the peculiarity in question would almost certainly be obliterated by free intercrossing. It might, however, occasionally happen that the same variation repeatedly occurred, owing to the action of peculiar and uniform conditions of life, and in this case it would prevail independently of selection. But when selection is brought into play all is changed; for this is the foundation-stone in the formation of new races; and with the pigeon circumstances, as we have already seen, are eminently favourable for selection. When a bird presenting some conspicuous variation has been preserved, and its offspring have been selected, carefully matched, and again propagated, and so onwards during successive generations, the principle is so obvious that nothing more need be said about it. This may be called methodical selection, for the breeder has a distinct object in view, namely, to preserve some character which has actually appeared, or to create some improvement already pictured in his mind. Another form of selection has hardly been noticed by those authors who have discussed this subject, but is even more important. This form may be called unconscious selection, for the breeder selects his birds unconsciously, unintentionally, and without method, yet he surely though slowly produces a great result. I refer to the effects which follow from each fancier at first procuring and afterwards rearing as good birds as he can according to his skill, and according to the standard of excellence at each successive period. He does not wish permanently to modify the breed; he does not look to the distant future, or speculate on the final result of the slow accumulation during many generations of successive slight changes; he is content if he possesses a good stock, and more than content if he can beat his rivals. The fancier in the time of Aldrovandi, when in the year 1600 he admired his own jacobins, pouters, or carriers, never reflected what their descendants in the year 1860 would become; he would have been astonished could he have seen our jacobins, our improved English carriers, and our pouters; he would probably have denied that they were the descendants of his own once admired stock, and he would perhaps not have valued them, for no other reason, as was written in 1765, "than because they were not like what used to be thought good when he was in the fancy." No one will attribute the lengthened beak of the carrier, the shortened beak of the short-faced tumbler, the lengthened leg of the pouter, the more perfectly enclosed hood of the jacobin, &c.—changes effected since the time of Aldrovandi, or even since a much later period—to the direct and immediate action of the conditions of life. For these several races have been modified in various and even in directly opposite ways, though kept under the same climate and treated in all respects in as nearly uniform a manner as possible. Each slight change in the length or shortness of the beak, in the length of leg, &c. has no doubt been indirectly and remotely caused by some change in the conditions to which the bird has been subjected, but we must attribute the final result, as is manifest in those cases of which we have any historical record, to the continued selection and accumulation of many slight successive variations.* * In the foregoing cases we have supposed that a sudden variation, conspicuous enough to catch a fancier's eye, first appeared; but even this degree of abruptness in the process of variation is not necessary for the formation of a new breed. When the same kind of pigeon has been kept pure, and has been bred during a long period by two or more fanciers, slight differences in the strain can often be recognised. Thus I have seen first-rate jacobins in one man's possession which certainly differed slightly in several characters from those kept by another. I possessed some excellent barbs descended from a pair which had won a prize, and another lot descended from a stock formerly kept by that famous fancier Sir John Sebright, and these plainly differed in the form of the beak; but the differences were so slight that they could hardly be described by words. Again, the common English and Dutch tumbler differ in a somewhat greater degree, both in length of beak and shape of head. What first caused these slight differences cannot be explained any more than why one man has a long nose and another a short one. In the strains long kept distinct by different fanciers, such differences are so common that they cannot be accounted for by the accident of the birds first chosen for breeding having been originally as different as they now are. The explanation no doubt lies in selection of a slightly different nature having been applied in each case; for no two fanciers have exactly the same taste, and consequently no two, in choosing and carefully matching their birds, prefer or select exactly the same. As each man naturally admires his own birds, he goes on continually exaggerating by selection whatever slight peculiarities they may possess. This will more especially happen with fanciers living in different countries, who do not compare their stocks and aim at a common standard of perfection. Thus, when a mere strain has once been formed, unconscious selection steadily tends to augment the amount of difference, and thus converts the strain into a sub-breed, and this ultimately into a well-marked breed or race. The principle of correlation of growth should never be lost sight of. Most pigeons have small feet, apparently caused by their lessened use, and from correlation, as it would appear, their beaks have likewise become reduced in length. The beak is a conspicuous organ, and, as soon as it had thus become perceptibly shortened, fanciers would almost certainly strive to reduce it still more by the continued selection of birds with the shortest beaks; whilst at the same time other fanciers, as we know has actually been the case, would, in other sub-breeds, strive to increase its length. With the increased length of the beak, the tongue would become greatly lengthened, as would the eyelids with the increased development of the eye-wattles; with the reduced or increased size of the feet the number of the scutellæ would vary; with the length of the wing the number of the primary wing-feathers would differ; and with the increased length of the body in the pouter the number of the sacral vertebræ would be augmented. These important and correlated differences of structure do not invariably characterise any breed; but if they had been attended to and selected with as much care as the more conspicuous external differences, there can hardly be a doubt that they would have been rendered constant. Fanciers could assuredly have made a race of tumblers with nine instead of ten primary wing feathers, seeing how often the number nine appears without any wish on their part, and indeed in the case of the white-winged varieties in opposition to their wish. In a similar manner if the vertebræ had been visible and had been attended to by fanciers, assuredly an additional number might easily have been fixed in the pouter. If these latter characters had once been rendered constant we should never have suspected that they had at first been highly variable, or that they had arisen from correlation, in the one case with the shortness of the wings, and in the other case with the length of the body.

Enough has been said and transcribed to explain the character and value of Mr. Darwin's new book. As a study of physical science it is a masterpiece, and will be referred to as such by all who value purely scientific methods. The central idea of the book, as of Mr. Darwin's previous work, we leave to the continued, and probably endless, discussion it will receive in all quarters. Fierce followers of Mr. Darwin will be alternately elated and disappointed with his materials. This is natural enough in the case of a conscientious experimenter. He is himself the subject of ever varying feelings. Hence the patience he exhibits; hence the fine and admirable modesty which marks his deliverances. That he has added much to the defence of the theory of the "survival of the fittest" is certain. It is here, as Mr. Darwin thinks, exemplified in the domestication of races. We shall await with great curiosity his prosecution of the subject into the sphere of pure and untouched nature. If it can be shown that the struggle for existence in that sphere does what human influence accomplishes out of it, a positive advance will have been made in scientific research. A step onward will have been made. The *destruction of the least fitting* explains the disappearance of forms between extremes of the most opposite appearances, and forces the acceptance of the idea of the development of new species. That these results have occurred, and do still occur, in the natural history of animals and plants under domestication it is the object of Mr. Darwin to show in the volumes we have so imperfectly but willingly noticed.

LITERATURE.

[illegible] of Movement in Plants. By CHARLES DARWIN, LL.D., F.R.S., assisted by FRANCIS DARWIN. With [illegible]. (London: John Murray.)

THE unceasing industry of Mr. Darwin, his perseverance in making observations, and the care he takes in preparing them for publication, and so placing them at the disposal of other students, deserves the warmest recognition of those who are competent to appreciate such valuable and self-denying labours. Even those who cannot accept all the conclusions deduced by the great naturalist from his observations, who are able to estimate their value and importance, will be anxious to acknowledge their indebtedness; for no one, we feel assured, can venture to question the good faith and sincerity of purpose with which the observations are made, or the care which is always taken to ensure accuracy of statement in presenting them to the public. We therefore feel sure that almost every naturalist will hail with thankfulness the present volume, which has a positive and undoubted value for every student of nature. Its chief object, as stated in the introduction, with much modesty, is "to describe and connect together several large classes of movement common to almost all plants." For the most commonly prevalent movement, Mr. Darwin has coined the word "circumnutation." From the evidence adduced, it seems probable that every growing part of every plant indulges in the movement so designated. The great sweeps made by the stems of twining plants, and by the tendrils of other climbers, are reasonably supposed to result from a mere increase in the amplitude of the ordinary movement of circumnutation. Plants, the leaves of which "sleep" at night, when their blades assume a vertical position, presumably owe this protective movement to modified circumnutation, and employ it to protect their upper surfaces from being chilled through radiation. Everyone who has watched the development of plants raised from seeds, must be aware of the almost invariable arched condition of the hypocotyl as it lifts the cotyledons above the surface. But probably very few are aware of the great force which plants at this early stage of their existence are able to exert, and what obstacles to their appearance above the soil they are able to overcome. Mr. Darwin mentions that he ascertained that the epicotyl (plumule) of a common bean grew upward with a force sufficient to lift a thin plate of zinc loaded with a weight of twelve ounces. Two more ounces were added, and the fourteen ounces were lifted up a little and then the tender shoot yielded and bent to one side. In all the germinating seeds observed by Mr. Darwin, the first change noticed was the protrusion of the radicle, which immediately bent downwards. As soon as the tip of the radicle protruded from the seed coats, it began to circumnutate, and the whole growing part continued to do so as long as the observations continued. The tip of the radicle also seems to be endowed with a selective power which enables it to alter the direction of its movement when it comes in contact with any substance too hard for it to penetrate, and to follow the line of least resistance. The observations on this point are both numerous and important. Many other points were satisfactorily investigated, and definite conclusions of much importance arrived at. According to Mr. Darwin's usual practice, the details of his observations are printed in smaller type than the conclusions arrived at, which the general reader will find to contain the gist of this interesting book.

Midland Counties Herald

GEOLOGICAL SOCIETY OF DUBLIN.

A GENERAL meeting of the society was held on Wednesday evening in the Museum Building, Trinity College. The chair was taken at eight o'clock by the Rev. Professor Haughton, President of the Society.

George Smith, Esq., of College-green, was elected a member of the society.

The President read his paper on the "Comparison of Modern Theories of the Origin of Species." After explaining the opinions of ancient philosophers on this interesting subject, he said the sciences of geology and political economy are mainly answerable for the revival of these exploded and forgotten fancies—geology, in supplying the lost history of organic life, which could never be studied profoundly from the creatures living at any given time; and political economy, in furnishing, from its mean and sordid motives, a Malthusian force supposed to be sufficient to supply the wants of previous theories. One of the earliest speculators on the origin of the diversified forms of life we see around us, and class as varieties, species, and genera, was Buffon, who published in 1766 his theory of the derivation of all mammal forms, by Degradation, from fifteen primary and perfect types, and nine special or isolated species. Some of the classes given by Buffon are as old as the time of Moses, who defines with some approach to accuracy, the class Ruminantia, distinguishing it from Pachydermata and Rodentia, in his classification of human breeding on domestic animals to be capable of production in ten or twenty years, he denies the right of his adversaries to appeal to the unaltered condition of the ass, the ostrich, or the cat, for three thousand years as a proof that specific forms balance round central types, and have no tendency to depart indefinitely from them. He continues the progress made to develop the subject:—Lamarck is the father of the Progressionists, and of the many who quote his name as an authority in support of their system, or express their disapproval of his doctrine, few have taken the trouble to understand his theory or to trace it to its origin. It is apparently founded on the confusion of species, like that of Buffon; but there is in reality an *arriere pensé*, like an unseen presence, which corrupts his reasoning and discloses the motive force of his entire system. This hidden spring of action and theorising is a profound, and, as many think, a well-founded, contempt for humanity, which pervade his writings as thoroughly as it does the Voyage to the Houyhnhnms. Lamarck was too quick-witted and acute an observer, however deficient he may have been as a reasoner, to have believed his own theory, the mainspring of which is the desire to degrade man into an intelligent baboon or yahoo—what difference is there in a name? In his desire to do so he overlooks every fact at variance with his foregone conclusion, and writes of mankind with a virulence, which, though devoid of the wit of Swift, springs from the same profound and unalterable conviction of the worthlessness of the creature he describes. Lamarck's contempt for his species is again shewn in the strange list of resemblance he selects for his comparison between man and the chimpanzee, a comparison fully as degrading as Swift's mock imitation of a naturalist's description of a yahoo. Lamarck's theory consists in the assertion of six laws in number, which he dignifies with the title of laws of nature. Lamarck's theory is essentially one of Progression, and is totally opposed to that of Buffon, which is one of Degradation, yet it is remarkable that they both rest upon the same foundation—the assumed non-reality of species. Like his successors in the progression theory, Lamarck spent his life in the establishment of the reality of species, and it is a humiliating reflection that, at the close of it, he believed himself to have lived under a delusion. What must we think of the principles that guide the speculations of naturalists when we find minds like those of Buffon and Lamarck drawing opposite conclusions from the same premises. It matters little in this question whether the premises be true or false, whether species be truly distinct or not; our surprise at the logic of the naturalists is natural, and must border on a courteous contempt. The English revival of Lamarckianism, or progress in organic life, by Mr. Darwin, does not contain a single idea in advance of those contained in Lamarck's six laws which he explains. I propose to test this strange theory by a corresponding theory of the mineralogical succession of igneous rocks, which opens up a fertile field of speculation hitherto unwrought. The igneous rocks of the Palæozoic period contain abundance of felspars, whose principal constituent is potash; the Mesozoic igneous rocks abound in soda, replacing potash; and in the Tertiary period soda itself gives way to lime and magnesia. Viewed in the light of the Lamarckian philosophers, here is a distinct indication that soda and lime are only allotropic conditions of potash. We may read the history of their formation in the crust of the globe, if we will only open our eyes and see it written. I may add, by the way, that this theory of the origin of lime is more intelligible

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than that of many geologists, who would attribute the greater accumulations of calcareous rocks in secondary and tertiary strata to the creation of lime by organic force. I may further add, that this allotropic condition of matter is not without support from our present experience (similar to that given to the law of natural selection from experiment on breeding), as one of the best living chemists believes it probable that chlorine, bromine, and iodine are really one. If any chemist or mineralogist were to put forward such a geological theory of the origin of soda and lime as the foregoing, he would be regarded as a lunatic by other chemists and mineralogists. How does it happen that a theory of the origin of species which rests on the same basis, is accepted by multitudes of naturalists as if it were a new gospel? I believe it is because our naturalists, as a class, are untrained in the use of the logical faculties which I charitably suppose them to possess in common with other men. No progress in natural science is possible as long as men will take their rude guesses at truth for facts, and substitute the fancies of their imagination for the sober rules of reasoning. It has been well observed by the greatest of living Palæontologists, 'that past experience of the chance aims of human fancy, unchecked and unguided by observed facts, shews how widely they have ever glanced away from the gold centre of truth.'

Mr. W. Ogleby made some remarks.

Mr. Alphonse Gages read a paper on the formation of orpiment in a mass of sulphate of pyrites, found interstratified with the carboniferous

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Morning Post Dec 23/81

ON WORMS.

A new work by Mr. Darwin is certain to create a sensation, not only in the world of science, but also in what is usually called the general reading public. The reason for this popularity is obvious. Darwin is perhaps of all scientific writers the most interesting and readable to those persons who usually dread the mere mention of a book on learned subjects. Nobody knows better than he how to popularise a theory and to cast over it a certain veil of romance which renders it peculiarly fascinating, and this he does so skilfully that scientific truth is never perverted for merely artistic purposes. This latest work "The Formation of Vegetable Mould through the Action of Worms" contains information of the most deeply interesting character, which even the ordinary reader will find surprising, indeed almost incredible. The silent and mysterious agents, so usually despised, who perform day and night the office of Nature's ploughmen, are certainly marvellous illustrations of the old saying, "God often uses the humblest tools to effect His greatest purposes." Worms have hitherto been treated, even by men of science, with contempt, and it is to Professor Darwin that they owe their elevation to their present somewhat novel "social position" in the animal world. They are, indeed, by no means such uninteresting or insignificant creatures as we are apt to believe them, and it seems are not without a certain kind of intelligence, which appears akin to reflection. Ever since 1837, when Mr. Darwin first read a paper upon their habits, they have been the objects of his constant attention and study. By night and by day has he watched them; sometimes spending hours in the dead of night contemplating their creeping movements, and this in his stockinged feet in order to avoid any undue vibration of the floor which might disturb them. That the result of such profound observation should be valuable is unquestionable, but even Professor Darwin's staunchest friends and his bitterest opponents must now confess that this remarkable book has surpassed expectation and is exhaustive. In short, it is a standard work of science, written with a succinctness and ease which renders it equally entertaining and instructive.

In his "Introduction," Mr. Darwin at once informs us that "the share which worms have taken in the formation of the layer of vegetable mould which covers the whole surface of the land in any moderately humid country" is the main object of his book. After describing this mould as being of a "generally blackish colour and a few inches in thickness," Mr. Darwin proceeds to explain how by the persistent action of the worm tribe this mould is constantly being turned over, triturated, and improved, thus in verity "all the vegetable mould throughout the country passes many times through the intestinal canals of worms, and that in consequence it would be actually more correct to say 'animal mould' rather than vegetable."

"Earth worms abound in England in many different stations. Their castings may be seen in extraordinary numbers on commons and chalk downs, so as almost to cover the whole surface, where the soil is poor and the grass short and thin. But they are almost or quite as numerous in some of the London parks, where the grass grows well, and the soil appears rich. Even in the open field, worms are much more frequent in some places than in others, without any difference in the nature of the soil. They abound in sewed countryside close to houses, and an instance is known in which they had burrowed through the floor of a very damp cellar. On the mountains of North Wales and on the Alps worms, as I have been informed, are in most places rare, and this may perhaps be due to the close proximity of the subjacent rocks, into which they cannot burrow during the winter so as to escape being frozen. Dr. M'Intosh, however, found them at a height of 3,000 feet, on Schiehallion, in Scotland. They are numerous on mountains near Turin, at from 2,000 to 3,000 feet above the sea."

Earth-worms may be considered as terrestrial animals, though they are still in one sense semi-aquatic, like the other members of the great class of annelida. M. Perrier found that they could not endure exposure in a dry room for a single night. On the other hand, Darwin tells us he has kept them alive for months under water. Worms are nocturnal in their habits, and can be seen after dark crawling about, but usually with their tails still inserted in their burrows. During the pairing season they come out of their holes even by day, and expose the greater part of their bodies for an hour or two in the early morning. The body of a large worm consists of from 100 to 200 almost cylindrical rings or segments, each furnished with minute bristles. The muscular system is well developed. The mouth is situated as the anterior end of the body, and is provided with a little projection, which is used for prehension. Worms breathe by their skins, as they do not possess any special respiratory organs. The two sexes are united in the same individual, but two individuals pair together.

"Worms are destitute of eyes, and at first I thought that they were quite insensible to light, for those kept in confinement were repeatedly observed by the aid of a candle, and others out of doors by the aid of a lantern, yet they were rarely alarmed, although extremely timid animals. Other persons have found no difficulty in observing worms at night by the same means. I noticed that when worms were illuminated by a bull's-eye lantern having slides of dark red and blue glass, which intercepted so much light that they could be seen only with some difficulty, they were not at all affected by this amount of light, however long exposed to it. Sometimes a strong light appeared to distress them; but I doubt whether it really does, for on two occasions, after withdrawing slowly, they remained for a long time with their anterior extremities protruding a little from the mouths of their burrows, in which position they were ready for instant and complete withdrawal. The light was once concentrated on a worm lying beneath water in a saucer, and it instantly sank into its burrow."

As these animals are only affected by light when it falls directly on the head, and as they have no eyes, it is, Dr. Darwin thinks, evident that the light affects the cerebral ganglia through the skin. Worms are quite deaf. Still they are sensible to certain vibrations. For instance, when placed upon a piano they retreated immediately into their burrows when the note C was struck, and so on with other notes. The body of a worm is extremely sensitive to touch.

"There is little to be said on the head of mental qualities of worms. We have seen that they are timid. It may be doubted whether they suffer as much pain when injured as they feel when touched contemptuously. Judging by their eagerness for certain kinds of food, they must enjoy the pleasure of eating. Their sexual passions are strong enough to overcome for a time their dread of light. They may perhaps have a trace of social feeling, for they do not object to crawl over each other. According to Hoffmeister, they pass the winter either singly or rolled up with others into a ball at the bottom of their burrows."

Mr. Darwin appears to doubt that a worm has sufficient intelligence to find its way back to a burrow which it has once left. They have a fashion of lying near the mouths of their burrows for hours together, and, of course, readily fall victims to the blackbirds and other enemies.

"If worms are able to judge, either before drawing or after having drawn an object close to the mouths of their burrows, how best to drag it in, they must acquire some notion of its general shape. This they probably acquire by touching it in many places with their anterior extremity, which serves as a tactile organ. It may be well to remember how perfect the sense of touch becomes in a man when born blind and deaf, as are worms. If worms have the power of acquiring some notion, however rude, of the shape of an object and of their burrows, as seems to be the case, they do not seem to be called intelligent; for they then act in nearly the same manner as would a man under like circumstances."

Having thus acquired some notion of the construction and attributes of worms, the reader is introduced to the last, and by far the most important, part of this singular book—the use of worms. They are the makers of mould and its greatest fertilisers. These silent creeping creatures, whilst we walk thoughtlessly over them, enjoying the beauties of the land, its greeness and its flowers, are labouring for our benefit. Nay, the very antiquary is greatly indebted to them for the preservation of monuments of remote antiquity. To give some idea of the industry and of the enormous amount of labour performed by these sightless creatures, Mr. Darwin tells us that—

"Coal cinders had been spread over a part of a field near Maer Hall, Staffordshire, in 1834; and when holes were dug to see the condition of things after a lapse of four years the cinders were found to form a line of black spots round the holes, at a depth of one inch beneath the surface, although covered by about 5 inches of lime. Over another part of the field cinders had been placed only about half a year before, and these either lay on the surface or were entangled among the roots of the grasses; and I here saw the process, for worm casts lings had been heaped on several of the smaller fragments. After an interval of four and three-quarter years this field was re-examined, and now the two layers of lime and cinders were found almost everywhere at a greater depth than before by nearly an inch—that is, we will say by three-quarters of an inch. Therefore moulds to an average thickness of the 22d part of an inch had been annually brought up by the worms, and had been spread over the surface of this field. Coal cinders had been strewn over another field, at a date which could not be positively ascertained, so thickly that they formed (October, 1871) a layer one inch in thickness at a depth of about three inches from the surface. The layer was so continuous that the overlying dark vegetable mould was connected with the subsoil of red clay only by the roots of the grasses, and when these were broken the mould and the red clay fell apart. I will now give some cases of the action of worms on land differing widely from the dry sands or the swampy pastures just mentioned. The following facts relate to the soil round my house in Kent, and its surface, from having been exposed during an immense period to the dissolving action of rain water, is extremely irregular, being promptly fashioned and penetrated by many deep well-like cavities. During the disintegration of the finer and soluble matter, including a vast number of rounded flints of all sizes, have been left on the surface, and form a bed of stiff red clay full of flints, and generally from six to fourteen feet in thickness. Over the red clay, wherever the land has long remained as pasture, there is a layer a few inches in thickness of dark-coloured vegetable mould."

But not only do worms bring an incredible quantity of earth to the surface by their action and their powers of forming what are popularly known as "worm castings," but they actually bury things by covering them with the earth they throw up. It must always be remembered that the number of worm labourers in the earth is something incredible. Heusen declares that in a hectare of ordinary land there is usually about three hundred and fifty-six pounds of worms, or about 53-707 per acre, and in corn fields pretty nearly double the number. When this fact is taken into consideration it is easy to understand that the labour performed by such a population of workers is prodigious. So great, indeed, that when we reflect that a single worm throws up annually about twenty ounces of dry earth we may easily comprehend the vastly important part these despised creatures play in nature. Mr. Darwin is certain that archæologists owe an extraordinary debt of gratitude to worms for the careful labours towards the preservation of works of antiquity. The rapidity with which they will cover up an ancient pavement in astonishing ease in less than two years they have been known to conceal a tesselated pavement in a ruined abbey and actually so thickly that grass and weeds have begun to grow upon their earthy coverings. Worms, moreover, prepare the ground in an excellent manner for the growth of fibrous-rooted plants and for seedlings of all kinds. They practically expose the mould to the air, and sift it so that no stones larger than those which they can swallow are left in it. They mingle the whole together like a gardener who prepares fine soil for his choicest plants. In this state it is well fitted to retain moisture and to absorb all soluble matters, as well as for the process of nitrification. The bones of dead animals, the harder parts of insects, the shells of land molluscs, leaves, twigs, &c., are before long all buried beneath the accumulated castings of worms, and are thus brought in a more or less decayed state within the reach of the roots of plants. Worms likewise drag an infinite number of dead leaves and other parts of plants into the burrows, partly for the sake of plugging them up, and partly for food.

The last passage in the book is so full of noble thought and so suggestive that its quotation will, perhaps, more aptly close this review than any further observations or tributes of praise.

"When we behold a wide turf-covered expanse we should remember that its smoothness, on which so much of its beauty depends, is due chiefly due to all the inequalities having been slowly levelled by worms. It is a marvellous reflection that the whole of the superficial mould over any such expanse has passed through the bodies of worms. The plough is one of the most valuable of man's inventions and one of the most ancient, but long before he existed the land was in fact regularly ploughed by worms. It may be doubted whether there are many other animals which have played so important a part in the history of the world as these lowly-organised creatures. Some other animals, however, still more lowly organised, namely corals, have done far more conspicuous work in having constructed innumerable reefs and islands in the great oceans, but these are almost confined to the tropical zone."

Mr. Darwin's last book is in every sense the equal of any one of its celebrated predecessors; charming in its style and fully evidencing profound learning, and full of evidence of the most patient and self-sacrificing observation. There is something touching in the picture drawn by the thoughtful mind of one of the most learned men of our age passing long hours in the dead of the night (in his stockinged feet, fearing lest the vibrations caused by his shoes might dis-

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